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**THE TEMPLETON CROCKER EXPEDITION OF THE
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No. 23

THE ROCCELLACEAE

**With Notes on Specimens Collected During the Expedition
of 1905-06 to the Galapagos Islands**

BY

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PART I

This portion of the paper deals with specimens collected by Alban Stewart during the 1905-1906 expedition of the California Academy of Sciences to the Galapagos Islands, and is based on material in the Farlow Herbarium of Harvard University and the Herbarium of the California Academy of Sciences. The numbers cited below are those of the Stewart collection.

***Rocella portentosa* Mtg.**

Darbishire, O. V., *Monographia Roccelleorum*, *Bibliotheca Botanica*, p. 29, pl. 7-11, figs. 27-41, 1898; idem, *Pflanzenareale* 2 (part 1): p. 4, 1928; Farlow, W. G., *Thallophytes and Musci of the Galapagos Islands*, *Proc. Am. Acad. Arts Sci.* 38: 83, 1902; Zahlbruckner, A., *Cat. Lich. Univ.* 2: no. 4187, 1924.

The specimens were on the whole apparently very weather beaten and old, but in their general habit quite typical of the species.

No. 393. Common on rocks, Barrington Island, October 20, 1905.

No. 394. Common on the sides of cliffs, Hood Island, September 26, 1905.

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Roccella Babingtonii Mtg.

Darbishire, O. V., *Monographia Roccelleorum*, Bibliotheca Botanica, p. 47, pl. 18-19, figs. 83-85 and 87 and 88, 1898 (as *R. peruensis* Krphbr.); idem, *Pflanzenareale* 2:4, 1928 (as *R. peruensis* Krphbr.); Farlow, W. G., *Thallophytes and Musci of the Galapagos Islands*, Proc. Am. Acad. Arts Sci. 38: 87, 1902; Wainio, E. A., *Lichens. Catalogue of "Welwitsch's African Plants,"* part II, p. 434, 1901;¹ Zahlbruckner, A., *Cat. Lich. Univ.* 2: no. 4168, 1924.

The specimens were all typical, exhibiting the characteristic yellow coloring of the medullary hyphae inside the attachment organ.

- No. 382. Abundant on trees and bushes on the lower and dryer parts of the island, Villamil, Albermarle Island, March 7, 1906.
- No. 386. Common on the branches of trees on the lower parts of Charles Island, October 4, 1905.
- No. 387. Common on dead bushes, Hood Island, September 26, 1905.
- No. 388. The same, collected September 25, 1905.
- No. 390. On dead bushes, Indefatigable Island, southeast side, October 27, 1905.
- No. 391. Common on trees of *Bursera graveolens*, Jarvis Island, December 20, 1905.
- No. 392. The same, Barrington Island, October 26, 1905.

Roccellodea nigerrima Darbishire

Darbishire, O. V., A new genus of Roccellaceae. *Ann. Cryptog. Exot.* 5: 153, pl. 3, 1932.

The specimens in question were rather broken up. This is typical of the species. In form and anatomy too, the specimens correspond to the type. The apothecia however were old and blackened. The soralia were those typical of the species. The specimens were labelled *Roccella portentosa* Mtg. but certainly do not belong to that species. I do not really doubt that they belong to *Roccellodea nigerrima*.

- No. 395. Common on the sides of cliffs, Hood Island, September 26, 1905.
- No. 396. Covering the lower sides of projecting masses of lava, Charles Island, October 5, 1905.

¹ Wainio looks upon *R. peruensis* Krphbr. as always soraliferous and *R. Babingtonii* Mtg. as not bearing soralia.

PART II

The specimens mentioned in the second part of this paper were collected, for the most part, during the Templeton Crocker Expedition of the California Academy of Sciences in 1932. The specimens are deposited in the Herbarium of the California Academy of Sciences and in the Fariow Herbarium of Harvard University.

***Dendrographa leucophaea* (Tuck.) Darbishire**

Darbishire, O. V., *Monographia Roccelleorum*. Bibl. Bot., p. 65, pl. 27, fig. 121, 1898; Zahlbruckner, A., *Cat. Lich. Univ.* 2: no. 4159, 1924.

(a) Collected on San Nicolas Island, California, *J. T. Howell*, March 13, 1932.

These specimens were fully grown, exhibiting externally the characteristic smooth, though stringy appearance of the cortex. Anastomoses between branches were not infrequent. Apothecia were plentiful and on the younger branches spermogonia also occurred.

(b) Collected at the south end of Guadalupe Island, Lower California, *H. L. Mason*, April, 1925.

These specimens were small and evidently represented young plants. The surface was smooth but in section showed the structure associated with *Dendrographa leucophaea*. Anastomoses were common, but apothecia and spermogonia completely absent.

***Roccella fimbriata* Darbishire, spec. nov.**

Plate 16, figures 1, 2; plate 17, figures 3, 4.

Thallus fruticulosus, basi placenta substrato affixus. Placenta² bene evoluta, crassa margine crescens, strato corticali instructa ex hyphis formato rectis, strato gonidiali instructa et strato medullari, cuius hyphae internae intense luteae sunt sed externae et substrati propincae nigrescentes. Podetia recta, basin versus constricta sed mox amplificata, complanata, ramosa, fimbriata, usque ad 6 et 10 mm. lata, et rarissime 15 mm., ad 10 cm. alta, apicibus angustioribus et paulo teretibus; stratum corticale ex hyphis formatum transversalibus, rectis; stratum gonidiale distinctum; gonidia *Trentepohliae* species; stratum medullare ex hyphis formatum longitudinalibus, conglutinatis, chondroideis. Apothecia lateralialia, aut superficialia, basi paulo constricta et breviter stipitata, rotundata, 1 mm. lata, disco nigro instructa pruinoso, margine pallido, paulo elevato, laevi, deinde crenato, hypothecium nigrum, sub media parte ad 200 μ crassum, parathecium versus 30 μ crassum, gradatim in parathecium transiens, tenue; amphithecium evolutum, marginem efficiens, gonidiis instructum; paraphyses ramosae, apicibus fusciscentes (epithecium) et foris pruinam albidam efficientes; thecium 60 μ altum; asci 10 μ crassi; sporae octonae, decolores, 28-32 x 5-8 μ , quadriloculares, paulo arcuatae, fusiformes. Spermogonia (apotheciis propinqua) simplicia, immersa, sed ostiolo paulo elevato, perithecio instructa decolori; ostiolum decolor; spermatia bacillariformia, curvatula, 12-14 x 0.5 μ . Soralia non visa.

² The term "placenta" is due to Wainio (*Lich. Welw.* 1901, p. 443). It stands for "attachment organ" and it is to take the place of the "thallus" and "protothallus" of various authors, at any rate in the case of *Roccella*. It corresponds to the German term "Haftscheibe" (*Lindau, Lich. Beitr.* p. 59, 1895).

Habitat ad saxa maritima, California Inferior, Americae borealis.

Rocella fimbriata a *R. fuciformis* differt reactione chemica et morphologica et placentae medulla interna lutea; a *R. Babingtonii* differt hyphis placentae externis nigrescentibus; a *R. Montagnei* differt medulla placentae lutea; et a *R. decipienti* hyphis luteis placentae et thallo latiore.

Type: Herb. Calif. Acad. Sci. No. 221700, collected at South Bay, CEDROS ISLAND, Lower California, *Templeton Crocker*, August 17, 1932. Also collected at south end of GUADALUPE ISLAND, Lower California, *H. L. Mason*, April, 1925.

The material from both these localities was plentiful and thus it was easy to establish a new species. There is no doubt in my mind that the specimen identified as *Rocella peruensis* Krphbr. and figured in my Monograph on plate 19, fig. 86, is not an exceptionally broad specimen of *R. peruensis* (= *R. Babingtonii* Mtg.) but that it belongs to the new species. It was collected by Dr. Eckfeldt in Lower California and sent to me in 1897 and it is now in my own herbarium. In the Farlow Herbarium there are also specimens belonging to *Rocella fimbriata* collected on Guadalupe Island by Dr. Edward Palmer in 1889 (Flora California, Guadalupe Island, No. 905c) and labelled *Rocella leucophaea* Tuck. and relabelled *R. portentosa* Mtg. Some specimens in the Herbarium of the University of Michigan from the same source (Flora of Southern California, Coronados Island, No. 260c) collected by Dr. Palmer in 1888, labelled *Rocella leucophaea* Tuck. are also *Rocella fimbriata*. These particular specimens showed a very large number of apothecia borne on the flat portion of the upright podetia.

Rocella fimbriata follows in the general differentiation of its thallus the usual type of the members of its genus such as *Rocella fuciformis* (L) DC., *R. Montagnei* Bel., and *R. Babingtonii* Mtg. in having a well developed attachment organ from which arise upright flat podetia.

The attachment organ is firmly fixed to a rocky substratum. The outer tissues in immediate touch with the substratum consist of blackish hyphae, whereas the inner medullary hyphae are intensely yellow in color. In addition, cortex and gonidial layers are seen. The whole attachment organ exhibits marginal growth and it is from the mature metathallus of the attachment organ that the upright podetia arise and in the end these stand so close together that little can be seen of the actual attachment organ. The cortex and gonidia together form a tissue about 120-140 μ in depth. The gonidia do not form a very dense layer but their *Trentepohlia*-branching is very clearly seen. The want of light at this point may affect the healthy development of the gonidia. The yellow hyphae of the medulla measure 2-3 μ in thickness and they possess a thin but hard

wall. The black hyphae are slightly thinner and also show a firm wall.

The upright flat podetia vary in breadth from 3-6 mm., with a height of about 10 cm. Occasionally the breadth may exceed 15 mm. The podetia are narrow just above the point where they are attached to the attachment organ. They then broaden out gradually. The branching seems to take the form of a splitting or lobing of the flat frond. Frequently numerous narrower portions arise on one or both sides of a flat podetium, thus producing a fimbriate appearance. The broadest portion is generally about 4-5 cm. above the attachment disk. In most of the specimens the branches seemed to bend over to one side but this may not be the case under natural conditions. In any case, branching seems to take place more or less in one plane. The side branches are always much narrower than the main stems. The color of the podetium is a faint yellowish or greenish-gray, merging sometimes into a deeper but faint reddish-brown. The color on one side is often darker than on the other. When the thallus is moistened, the color generally tends to become faintly greenish throughout. The upright thallus of this species is tough and hard and not easily bent. It is slightly brittle.

In the metathallus of the podetium, the cortex in its structure to a certain extent resembles that of *R. fuciformis*, fasciated bundles of hyphae passing out into the cortex and then spreading out to make the cortical hyphae stand out at right angles to the outer surface. The separate hyphae are not, however, so closely cemented together as they are in *R. fuciformis* and they form a smooth outer surface. In the median portion of a flattened podetium the cortex is 40-50 μ deep but groups of gonidia may push their way in between the hyphae bundles, often getting as near as 20 μ to the outside of the cortex. The cortical hyphae are 2-4 μ in diameter with a lumen of about 1.5 μ . Further inside, the hyphae have a smaller lumen. Between the gonidia, hyphae not passing out into the cortex are barely 2 μ in diameter. They are in touch with the gonidia by means of haustoria. The gonidia measure about 4 x 10 μ and are oval in shape and belong to the algal genus *Trentepohlia*. The whole gonidial layer may be 40-50 μ deep. The combined cortical and gonidial layers are deeper in the middle line of the flat podetium and much shallower at the edges. This is the case, too, with *R. fuciformis*. It is at this edge that the lateral expansion of the podetium mainly takes place and it is where the new hyphae are actively pushing their way into the cortex. Also, it is at this point that apothecia generally arise, and in *R. fuciformis*, also the soralia. In a younger portion of the podetium, the fasciated hyphae giving rise to the cortex are well seen.

The medulla of the mature podetium is of the usual *Roccella* type. The hyphae run longitudinally in the main, and they are firmly cemented to form strands. These strands anastomose in the way characteristic of *Roccella*. The separate hyphae are about 6-7 μ in diameter with a lumen barely 1 μ across. There are thinner hyphae between the bigger ones. Towards the attachment organ, the medullary hyphae become more closely cemented together.

Apothecia and spermogonia are found on the same podetia, often very close together, but in that case the latter are generally no longer active. Young spermogonia still containing spermatia are to be observed nearer the tips of the branches, where mature apothecia do not yet occur. The apothecia seem to arise mainly at the edges of the flat podetia. Many, however, are later formed on the flat surface, especially in the broadest specimens. This may in part be due to the apothecia gradually moving away from the edges as the fronds expand by active marginal growth. But that is not always so, and many apothecia certainly arise actually away from the edges. Apothecia appear to be mature when they are about 1 mm. in diameter, when they are circular in outline and have a black disc which is whitely pruinose. As the apothecia become older, their smooth and entire margin becomes crenate. These apothecia do not generally contain spores. As is the case in many species of *Roccella*, they just grow vegetatively and no longer function as apothecia.

The epithecium consists of dark brown hyphae about 1-2 μ thick which end in the colorless tips forming the pruina. The whole epithecium is about 40 μ deep. The thecium is 60 μ deep and the narrow asci are 10 μ across, the spores measuring 28-32 x 5-8 μ . They are in shape quadrilocular, cylindrical, slightly arcuate and colorless. The hypothecium is black and 200 μ deep under the center of the apothecium, tapering to 30 μ at the margin where it passes into the parathecium, which is thin and slightly brown. The hyphae of the hypothecium and parathecium are firmly united and thus form the usual air-tight cup in which the thecium rests. The amphithecium is well developed and contains gonidia. The whole apothecium is slightly raised above the level of the podetium and shows a constriction at that point. It therefore appears to be shortly stalked.

The spermogonia are of the usual flask-shaped form, the narrow ostiole being slightly elevated. The whole spermogonium is 170-200 μ high and 100-120 μ broad. The actual air-tight wall is colorless and about 25 μ thick. The spermatia are 12-14 μ long and about 0.5 μ thick. They are colorless and slightly curved.

Soralia have not been observed.



Fig. 1. *Roccella fimbriata* Darbshire, sp. nov. $\times 11/12$.

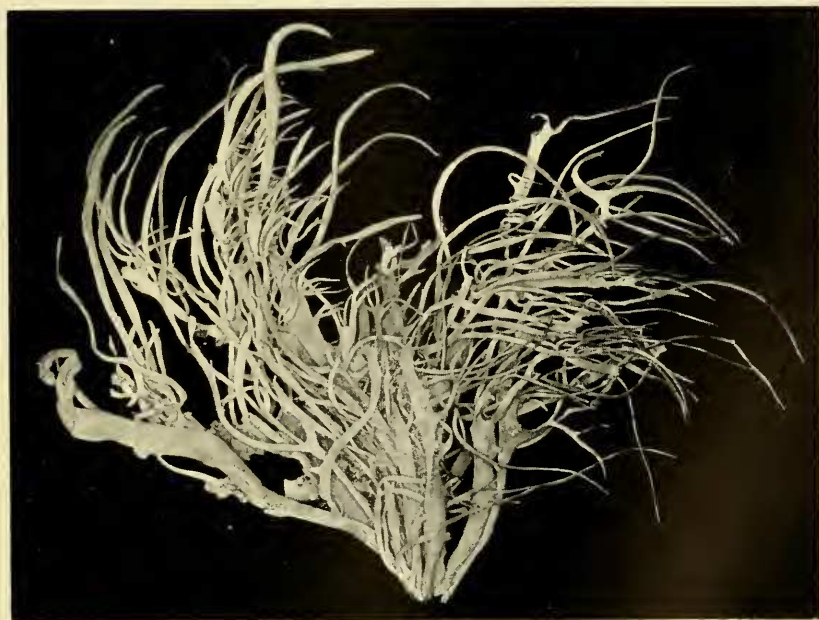


Fig. 2. *Roccella fimbriata* Darbshire, sp. nov. $\times 1/1$.



Fig. 3. *Roccella fimbriata* Darbshire, sp. nov. $\times \frac{7}{8}$.



Fig. 4. *Roccella fimbriata* Darbshire, sp. nov. $\times \frac{5}{8}$.

There is a certain resemblance between *R. fimbriata* and *R. Montagnei* Bel., *R. fuciformis* (L.) DC., and *R. Babingtonii* Mtg. The more or less uniformly broad and thick frond of the podetium of *R. fuciformis* separates this species from the new one. The gradual narrowing down from almost the base of the podetium of *R. Montagnei* and *R. Babingtonii* separates these two species. Of the four species, *R. fimbriata* and *R. fuciformis* are the hardest and toughest, though *R. fuciformis* is perhaps the more fragile. The medulla in the attachment organ of *R. Montagnei* and *R. fuciformis* is colorless, while yellow in the other two species. In addition, in *R. fimbriata*, the outer tissues of the attachment organ are black; the cortex of the podetium turns red with Ca ClO_2 in all cases except *R. fuciformis*. The podetia of *R. decipiens* Darbshire are narrower than those of *R. fimbriata* and the inner medullary hyphae of the attachment organ are white in color, but those in touch with the substratum are black.

